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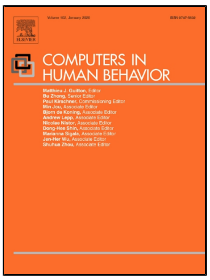

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Abstract

Currently little is known about how creativity is expressed in digital entertainment games or what specific design elements may foster it. Using a qualitative methodology, this article reports on the findings of 24 semi-structured interviews and 14 narrative surveys with regular players of different types of digital games. Using a hybrid thematic approach to analysis involving both deductive and inductive phases, three main categories relating to the expressivity of creativity were discovered and one category relating to the specific game design considerations which give rise to such creative opportunities. Creativity was found to be expressed in terms of creative problem-solving involving the creation of novel strategies, solutions and approaches to problems; in terms of appropriation involving emergent play practices and how gameplay was adapted for alternative goals; and finally, in terms of affective change involving the personally meaningful insights and changes in attitudes/perceptions which games elicited. Design considerations were also identified relating to: freedom of play, environment, replayability, tools, avatar design and content creation. By shedding light on the grey area of creativity in digital games and illuminating how games may support and promote creativity in players, this article provides a basis for future research and can help inform game design practices in both digital entertainment games and games specifically designed to facilitate creativity.

1. Introduction

This paper explores how creativity is expressed within digital games and what design considerations may enable different forms of creative expression. It has been argued that "rather than quantifying creativity as a trait, process or outcome, creativity should be considered the assimilation of these factors and the integration of thoughts, ideas, and actions into new directions, solutions and viewpoints" (Bowman et al., 2015, p. 42).

A number of benefits have been argued to be associated with creativity. For example, the use of creativity to solve everyday problems has been suggested to contribute to positive psychological health and well-being (Richards, 2007), and that those who are engage in creative activities are more likely to be happy and active (Silvia et al., 2014). According to Foregeard and Elstein (2014) creative thinking may "enhance and strengthen psychological flexibility by allowing individuals to generate new and effective cognitive, emotional, and behavioral strategies on their own" (Forgeard & Elstein, 2014, p. 1). Furthermore, creativity has been argued to facilitate adaptive prospection by enhancing other closely related processes such as psychological flexibility which relates to effectively adapting emotions, cognitions and behaviors to different situations (Kashdan & Rottenberg, 2010). Similarly, creative thinking can help counteract a number of negative psychological tendencies such as repetitive negative thinking (Harvey et al., 2004) and aid individuals in creating coping strategies and adopting adaptive interpretations (Fresco et al., 2006).

Creativity has been widely investigated in areas such as work, music and education with findings suggesting a variety of benefits of creativity such as positive psychological health (Richards, 2007, 2010). Conceptualisations of creativity such as Big C approaches focus on "professional" creativity, or works of creative genius (e.g. Csikszentmilhalyi, 1999; Gardner, 1993), while Little C approaches which argue everyone has creative ability which can be developed further by overcoming everyday problems and challenges (e.g. Maslow, 1968; Richards et al., 1988).

Approaches such as these have been criticised for failing to account for the many different categories of creativity between "genius" and "everyday" (Kaufman & Beghetto, 2009) and failing to recognise the multi-dimensionality of the nature of creativity. Works such as the Four C model of creativity (Kaufman & Beghetto, 2009) attempt to bridge this gap by accounting for Proc C creativity which refers to the progression from Little to Big C achievements, and Mini C creativity which explains the micro level, personally meaningful insights and affective change occurring in individuals. Other approaches such as the Person, Product, Press and Process Framework (Rhodes, 1961) attempt to account for the multi-faceted nature of creativity by examining creativity from various different perspectives. For example, the "person" perspective illuminates how personality factors such as intrinsic motivation facilitate creative behaviour (Amabile, 1990; Stohs, 1992), while the "press" perspective examines how situational influences such as time and autonomy impact creativity (Amabile & Gryskiewicz, 1989; Witt & Beorkrem, 1989).

Finally, there is the demarcation between creativity as a product and creativity as a process. The former includes definitions which refer to creativity as "'making up' something new and valuable by transforming what is into something better" (Young, 1985, p.77), or more commonly as creating

something which is both novel and appropriate (Ochse, 1990; Sternberg, 2006). The latter focus stresses that it is not so much the outcome which constitutes creativity but the imaginative process (Robinson, 2001). Additionally, creative thinking has been suggested to comprise of various creative cognition skills such as divergent, metaphorical and analogical thinking (Finke, Ward, & Smith, 1999).

1.1. Creativity Contextualised within Digital Games

Creativity within the context of digital games has been granted little focus, with very few studies giving the topic undivided attention. Several studies have illustrated the benefits of digital games on creativity, for example, Moffat et al. (2017) examined the effect of different genres of digital games on creativity scores (measured using Torrance Tests of Creative Thinking (TTCT)), finding gameplay contributed to a more creative state of mind. Similarly, Blanco-Herrera et al. (2019) used various creativity metrics such as the remote association test (RAT), alternative uses test (AUT) and alien drawing task (ADT) to examine the relationship between creativity and gameplay exposure using *Minecraft* (Mojang, 2011). They identified an overall positive correlation between self-reported gameplay exposure and trait creativity scores, with creativity scores being highest when participants were not given explicit instructions on what to do in the game (i.e. the game was presented in an open-ended manner). Cognitive flexibility, a key component of creative behaviour, has also been argued to be increased through gameplay, with findings suggesting that certain types of game genres such as Real-Time Strategy can increase cognitive flexibility (Glass et al., 2013) and, also slow cognitive decline in older adults (Basak et al., 2008).

The propensity of digital games to contribute towards greater creativity can also be seen in terms of learning, where creativity is argued to be a highly transferrable skill and incorporates a variety of traits and abilities such as problem-solving (Carvalho et al., 2015; Mayer, 1989), openness (Rogers, 1961), adaptability and cognitive flexibility (Runco, 2004). The education system is increasingly focusing on transferrable skills which are argued to be crucial in the new digital age, with several frameworks such as the 21st Century Learning Framework (Partnership for 21st Century Skills, 2019), Knowledge Age Skills Framework (Clough & Ferguson, 2010) and the European Commission's Digital Competence Framework (Kluzer et al., 2018) highlighting creativity as an important skill for the growing economy.

The act of play is often viewed as an inherently creative process which allows us to approach novel and challenging situations in a way that is free from the constraints of our external milieu, allowing us to experiment with alternative solutions and approach problems in ways we would otherwise not have done (Basadur, 1994; Mainemelis & Ronson, 2006; Runco & Sakamoto, 1999). Ill-structured challenges have been argued to be especially good at fostering creativity and contributing

to intrinsically motivating flow experiences (Kiili, 2005). Games are apt at providing players with ill-structured problems while gameplay appears to aid the development of problem-solving skills and creativity by allowing players to link abstract concepts to concrete gaming experience (Leng et al., 2010). Furthermore, previous findings have suggested that the positive emotions elicited through gameplay may also act as an important facilitator of creative performance (Yeh et al., 2016).

While ill-structured challenges have been cited to facilitate creative behaviour in games, the concept of emotional challenge has also been examined, with findings suggesting that games which provide emotional challenges may facilitate affective change in players. Emotional challenges often present players with emotionally difficult themes, leaving parts of the game narrative ambiguous and open to interpretation from the player. Bopp et al. (2018) examined emotional challenge within the context of commercial entertainment games and found when players confronted emotionally difficult themes which mirrored issues they had experienced in their real lives (e.g. death, illness or war) they "could derive personally meaningful insights" (Bopp et al., 2018, p. 9). Despite the negative feelings such challenges provoked, players often rated the overall experience as enjoyable and positive, and said that such experiences prompted them to further reflect on their actions within the game (Bopp et al., 2018). A subsequent study by Mekler et al. (2018) also found that games could provoke reflection in relation to the games themselves, and in the relation to the parallels to other aspects of life. However, they reported fewer instances of transformative reflection (e.g. reflection which resulted in the altering of behaviors, assumptions or views), something which could be attributed to the fact that the majority of participants did not play games which focused on prompting reflection outside the context of the game.

While the notion of challenge (both ill-structured and emotional) has been examined in relation to aspects of creativity, other work has looked at how players are able to appropriate their gaming experience. The term appropriation provides a broad overview of the ways in which players "adopt, adapt and incorporate technology in their practices, work, or leisure" (Herodotou et al., 2012, p. 34). Game appropriation includes but is not limited to: the creation of game modifications, the creation of game (or game-based) content as well as how players are able to make novel, and often unintended uses of game mechanics and alter the overall rules of a game. For example, work by Jarret (2014, 2015) which on the notion of *emergent play* (Juul, 2002), found that players of Massively Multiplayer Online Battle Area (MOBA) games were able to combine multiple game variables in ways not foreseen by developers e.g. the "Fountain Hook" move in *Dota 2* (Valve, 2013). Similarly, Aarseth's (2007) notion of *transgressive play* may illuminate how players are able to "exit the structure and rules of the game" (Van Vught & Glas, 2017, p.3) and perform unexpected actions. However, emergent and transgressive forms of play are restricted to gameplay only, and it has been

suggested that the term *transformative play* should be used instead as it applies to both play within the game and how aspects of play may flow from the game to other domains, such as the case of fan creations (Sotamaa, 2007).

Creativity has also been examined from a social innovation standpoint in how players challenge and reproduce the rules of social interaction. For example, Wright et al. (2002) found players of the game *Counter-Strike* (Valve & Turtle Rock Studios, 2000) created a variety of innovations in verbal dialogue and non-verbal expressions such as word plays, logos, and borrowing from popular culture (both in verbal references and map creations). Similarly, Ferguson (2011) looked at the how teenagers in the Schome Park Programme within the world of *Teen Second Life* (Linden Labs, 2005) were able to blend and reconfigure ideas and collaboratively develop a creative vision of their intended project (Ferguson, 2011). Similarly, from a storytelling perspective, Banks (2013), who focused on *World of Warcraft* (Blizzard Entertainment, 2004), found that players constructed stories about their characters, including how their gaming experience influenced said character's behaviors and emotions.

While creativity can take place within the game itself, players also create a multitude of artefacts around the game such as fanfictions, after action reports (AARs), game guides, game art and modifications. Burri (2011) defines User Created Content (UCC) as "all forms of expression made by users [which] range from contributions to chats, email or instant message exchanges, shared links, texts, videos and photographs created from scratch authored stories and films" (Burri, 2011, p. 3). She highlights the distinction between games where the developers allow and even encourage forms of UCC (e.g. Minecraft, Second Life) and games where it heavily restricted (e.g. World of Warcraft).

1.2. Research Questions

Previous work has examined some aspects of player creativity in digital games such as ill-structured and emotional challenges, emergent, transgressive and transformative play, social innovations and player creations based on the game. However, questions remain in relation to how player creations may differ depending on the level of restriction for UCC and whether players of different types of games view creativity in different ways? Not all games are created equal in their allowance for player created content though players appear to still able to be very creative in even the most restricted games. Thus, the research questions this paper seeks to address are twofold:

RQ1: What expressions of creativity can occur across different types of digital games?

RQ2: What design considerations of these games facilitate player creativity?

1.3. Purpose of the study

This study aims to add to the under-researched area of creativity and digital games and lay groundwork for future studies which explore more explicitly the different forms of creative expression by players. Additionally, through illuminating how creativity in expressed in digital games and what possibilities the medium may offer for creative behaviour, a greater understanding may be gained in terms of how digital games could be used to foster creativity in both entertainment games and educational games. This could apply to both games designed with the intent to encourage creative behaviour, as well as the use of commercial entertainment games in educational settings.

2. Materials and Methods

2.1. Methods of Data Collection

Creativity has been argued to be highly subjective and dependent on a variety of other factors such as personality, past gaming experience and preferred playstyle and as such qualitative studies are aptly suited to explore it. For example, Jarret (2014) used an ethnographic method to examine emergent play in MOBA games, while Wright et al. (2002) and Fergusson (2011) analysed chat logs. Studies such as these provide a rich and detailed insight into how players appropriate and adapt their gaming behaviour. This study follows in the same footsteps by adopting an explorative approach to the study of player creativity in digital games. While not providing the same micro level of detail as an ethnography or the social illumination of chat analysis, semi-structured interviews were chosen to provide a detailed insight into the different types of creative expression across a range of games and illuminate the design aspects that enable them. While the nature of the study was exploratory, the use of prompts in the semi-structured interviews provided a loose structure on which to guide the discussion while still leaving scope for asking probing questions and exploring connected topics. Please see table 1.1 for interview prompts.

Question No.	Literature Area	Question Text
1	General gameplay	What games are you currently playing? a. What gaming platforms are you using?
2	General gameplay	Can you describe a particularly engaging experience you have had recently whilst playing a game? a. What do you think contributed to making these experiences so engaging?
3	Problem-Solving	Has there ever been a time when you tried out or created a new way of doing something – either on your own or in a team?
4	Affective Change	Have there been any times during your gaming experience when you began to view things in a different way? For instance, when your views were challenged or changed?
5	Problem-Solving	Have you ever “discovered” a new way to go about something or use something in the game? (e.g. something you didn’t know was there before)

6	Appropriation	Have you ever used the game mechanics for uses other than what they were intended for? (e.g. glitches, cheats, alternative uses for game variables)
6	Appropriation	Have you ever created anything for the game or based on the game such as modifications, walkthroughs or fanfiction? a. What motivated you to do this?
7	Personal Perspective on Creativity	Do you think you are or can be creative when you play games? a. Do you feel you gain anything in particular from being creative in games? b. Would you use any of the skills/experience from being creative in other aspects of life?

Table 1.1: Interview Prompts

Due to a large volume of participants originally signing up for the study, additional data was collected using a narrative survey consisting of various "frames" relating to the interview questions. A narrative frame comprises of "a written story template consisting of a series of incomplete sentences and blank spaces of varying length" (Barkhuizen, 2011, p. 402). A narrative survey enables focused collection of textual data relating to the research questions and provides participants with a skeletal template on which to write their experiences, providing support in terms of both content and structure (Barkhuizen, 2014). While not yielding the same amount of rich qualitative data as an interview, narrative surveys can be aptly used to complement existing data from interviews, and also in the case of this study, aid in the triangulation of findings by using different data collection methods (Blandford, 2013; Twining et al., 2017). Please see table 1.2 for a list of the narrative frames.

Question No.	Literature Area	Frame
Q1b	**General**	An engaging experience I have had recently with a digital game was….. a. I found it particularly engaging because…
Q2a	**Problem-Solving**	A time when I tried out or created a new way of doing something in a game was when…. a. I did this by…
Q2b	**Affective Change**	A game which changed my views or made me view things differently was… a. This was because…
Q2c	**Problem-Solving**	A time when I discovered a new way to go about something or use something in the game was….
Q2d	**Appropriation**	An example of when I have used game mechanics for uses other than they were intended was when…
Q2e	**Appropriation**	Material I have created for a game/based on a game would include…. a. I was motivated to do this because….
Q3	**Personal Perspective on Creativity**	I think games are creative – yes/no a. If yes, I think games are creative because… a. When I am creative in games I feel I gain… b. I feel I am able to use the skills/experience gained from being creative in other areas of my life such as… b. If no, I think games are not creative because…

Table 1.2: Narrative Frames

2.2. Sample and Recruitment

The average age of those who play digital games in the US is 33 years old (ESA, 2019), while in the UK it is older at 43 years old (Ukie, 2018). In Europe the statistics are similar with those in the 25-34 year age bracket being the group with the fastest growth in gaming (ISFE, 2019). Of those that play digital games in the UK, there are no significant differences in effects of nationality, religious background, ethnicity and sexual orientation on gameplay behaviour (Borowiecki & Bakhshi, 2017). As such the sample chosen for this study was adults aged 18 and over, with consideration being given to obtain as equal numbers as possible of both genders. Participants were required to be regular gamers and play digital games at least three times a week.

A total of 38 participants, consisting of 24 interview participants, and 14 narrative survey participants, took part in the study. The semi-structured interview questions were piloted with four regular players (male = 2, female = 2, age median: 33). As no significant changes were made to the question list, the pilot data was included in the main analysis. For the main study convenience sampling was conducted via a wider recruitment survey advertised on various gaming forums and social media. Due to an imbalance of genders, the survey was advertised to female gaming groups on social media in order to obtain a more balanced sample. While this was achieved for the narrative survey, the interview sample consisted of a disproportionate number of males.

Participants who volunteered were sent a short survey to collect basic demographic and gaming habit information. 20 interviews were arranged and completed with participants. The 20 participants (male = 14, female = 6, age median: 28.5) consisted of 12 British, 2 German, 2 Spanish, 1 American, 1 Maltese, 1 Northern Irish and 1 undisclosed. Participants played a range of different digital games, both online and offline and the median gaming session lasted 3 hours. Interviews were conducted and recorded over Skype before being transcribed into textual format in preparation for analysis.

14 participants completed the narrative survey (male = 7, female = 7, age median: 31.5) consisting of 6 British, 4 American, 1 Australian, 1 Canadian, 1 Colombian and 1 Spanish. Participants played a range of online and offline digital games with the median gaming session lasting 1.86 hours.

2.3. Data Analysis

Thematic analysis was adopted to identify categories relating to the expressivity of creativity and player conceptualisations of creativity. Thematic analysis is a “method for identifying, analysing, and

reporting patterns (themes) within data. It organizes and describes a data set in (rich) detail" (Braun & Clarke, 2006, p. 6). A theme aims to identify something important within the data, in relation to the research question and represents a pattern of meaning within the data set. As such themes were identified across the whole data set (24 interviews and 14 narrative surveys). A hybrid approach (Swain, 2018) to theme development was applied consisting of both an initial deductive phase guided by previous literature on creativity in digital games, and a second inductive iterative phase to allow for additional themes and sub-themes and to be identified.

After the initial development of themes by the principal researcher the data was cross-checked by three colleagues. This aided in investigator triangulation by ensuring the themes were consistent and accurately captured the concepts portrayed (Blandford, 2013; Twining et al., 2017). Three iterations of inductive theme development took place before a theme agreement was unanimous due to dispute over several sub-themes. This resulted in the combining and reframing less prevalent sub-themes in the *Creativity as Affective Change* and *Design Considerations* themes. As the majority of references concerned appropriation examples it was decided to place it within the theme of *Creativity as Appropriation*.

3. Results

Themes were divided into two categories, the first of which related to the different types of creative expression within games, and the second relating to the design considerations which supported creativity. See table 2.1 for expressivity of creativity theme descriptors and table 2.2 for design considerations theme descriptors.

Table 2.1: Expressivity of Creativity

Main Theme	Sub-Themes	Description
Creativity as Problem-Solving	Creating Strategies	Relates to instances where a player creates strategies to use in the game, often involving experiential and trial and error approaches. This can either be done alone or within a team.
	Approaching Problems	Relates to the planning involved before deploying a strategy or set of tactics, such as consulting guides beforehand. Or alternatively, a specific way of approaching and managing difficult problems such as frustration.
Creativity as Appropriation	New Use for Existing Game Mechanic	Relates to the ways in which players were able to discover and use game mechanics for alternative uses.

	Creating New Challenges	Relates to instances where players had created new games or goals within the game or deliberately created additional challenges, such as upping the difficulty level or finding alternative, more challenging ways to play a game.
	Glitches	Relates to the use of glitches either as a source of fun or as a means of progression in the game.
Creativity as Affective Change	Moral	Relates to the changing or challenging of beliefs and views associated with moral issues such as right and wrong, good or evil, religion and gender equality.
	Personal	Relates to instances where players had changed or challenged opinions about themselves and their abilities, for instance realising that they could succeed at something they had otherwise believed they were not good at. Additionally, it included instances where the general outlook on daily life was changed, such as looking at things in a new light or thinking in a different way.
	Narrative	Focused on emotional connections with a game's narrative and characters, such as where a player felt empathy with an in-game character due to experiencing a similar circumstance or set of issues in their past.
	Games	Focused changes in the way players viewed games in general. Examples of this could be games which utilised new mechanics or storytelling methods which players had never seen before.
	Cultural	Relates to instances where a player's cultural views have been changed or they have come to regard other cultures in a new light.
	Existential	Relates to wider existential matters concerning humanity, existence and philosophical dilemmas

Table 2.1: Expressivity of Creativity Theme Descriptors

Table 2.2: Design Considerations

Main Theme	Sub-Themes	Description
Design Considerations	Freedom of Play	Relates to what a game affords in terms of how players can choose to play (e.g. are there multiple ways of doing something? Is it suited to multiple playstyles?) and how accessible it is to test the boundaries imposed by developers (e.g. what combinations of variables are permitted? Can glitches be found?).
	Environment	Includes opportunities to interact with the environment such as being able to utilise terrain and environmental objects, as well as opportunities to explore.
	Replayability	Encompasses what possibilities for replay there is (e.g. are there different endings? Can the game be played differently on each playthrough? Can each playthrough be a different experience?).
	Tools	Relates to affordances for the use of different types of tools. This includes weapons, abilities, controls and items.
	Avatar	Relates to what possibilities there are for avatar and character customisation, such as appearance, personality, dialogue options and classes.

Creation	Relates to what considerations there are for creating in-game content such as building or crafting things. Additionally, what possibilities there are for creating and integrating mods and add-ons.

Table 2.2: Design Consideration Theme Descriptors

3.1. Creativity as Problem-Solving

Creativity as problem-solving was a deductive theme identified originally from the literature review and centred around the novel ways in which players were able to overcome ill-structured game challenges. The most common method for inventing such strategies was through a "trial and error" approach whereby participants would test various tactics or strategies to determine which are successful.

> "I tend to invent stuff first. So, I would see what works and what didn't, and then continue with what works, a bit of a process of elimination."– Female, 29 (Interview)

This approach to overcoming challenges involved a significant amount of practising and refining. After an initial reflection on the outcome of the actions, participants described refining their strategies and forming hypotheses about which combination of actions may be fruitful: "you kind of almost pick apart what you did right and what you did wrong and then have another go and refine it and refine it" (male, 41, interview).

Participants stated that they always preferred to "give it a good go to work it out" (male, 31, interview) and felt a sense of achievement when they finally figured out the correct strategy. As one participant describes upon managing to beat a difficult monster in *Legend of Zelda: Breath of the Wild* (Nintendo, 2017):

> "You can work out ways to compensate for the fact that you've only got really a crappy weapon and use your environment around you to work it out. And I managed to figure out a way to chip away at this massive beast thing, kill it, and I was so proud of myself." – Female, 31 (Interview)

The sense of discovery of "working it out" often added to the overall enjoyment, suggesting taking an active role in the reflection and refinement process was a source of fun.

In addition to the instances of solo creativity mentioned, participants also cited times when they created strategies as part of a team effort. This included instances of playing with friends, relatives or as part of gaming guilds/clans. In reference to Massively Multiplayer Online Games (MMO's), participants often cited negotiating strategies and engaging in co-creativity with other team members. As one participant put it:

> "[I was] randomly put together with a squad where we had a good teamplay dynamic…it made the game more fun. We performed very well together. Some of the guys were on voice chat too and despite speaking different languages we were able to joke around some in each other's languages too" – Male, 28 (Narrative Survey)

While the creation of novel strategies was an existing theme identified from the current literature, one area of creativity in relation to problem-solving that has not been identified previously in relation to creativity relates to how players plan and approach various gaming issues. Unlike in the instances where participants created strategies via reflection and refinement, in these instances the general strategy was usually already anticipated or known through previous gaming knowledge. As one participant pointed out:

> "You get something and you think that's definitely going to have to be used later, and you just figure out the dots before the dots are even there." – Female, 29 (Interview)

While such instances may not ultimately guarantee a successful solution, they are able to provide players with a certain amount of scaffolding for difficult challenges. Other instances which involved participants approaching problems included instances when they got "stuck" or when repeated attempts at completing a particular challenge became too frustrating, often leading to a breakdown in gameplay. Instead of giving up, participants cited numerous strategies to manage these situations, such as "taking it slowly to avoid anxiety" (female, 21, narrative survey) and "taking a break [and] going back to it later" (male, 19, interview).

3.2. Creativity as Appropriation

Similar to creativity as problem-solving, the theme of creativity as appropriation was deductively derived from the current literature. In terms of finding new uses for existing game mechanics, participants referenced instances where they had used game mechanics in alternative ways to create shortcuts, overcome challenges or create mini-games within the game itself. New uses of game mechanics were often discovered as opposed to being looked up, and often were found as a result of experimenting with game variables or by accident. As one participant illustrated while playing *Divinity: Original Sin* (Larian Studios, 2014):

> "I found that you could put heavy things in this bag and then if you were to take that bag and put it in a box or something within the game world, that box would suddenly weigh thousands and thousands and thousands of kilograms. So, I once beat an enemy I was stuck on by filling a box full of ridiculously heavy things and dropping it on his head. And instantly killed him." – Male, 26 (Interview)

In addition to providing ingenious ways to kill monsters or tackle challenges, game mechanics were also used to create shortcuts through the game, as in the case of using dying and respawning mechanic in certain games which could be used "strategically because there is no penalty for dying" (male, 35, narrative survey).

In terms of the ways in which players created their own challenges within games, participants mentioned a) upping the difficulty of the game or using a playstyle they were not accustomed to or b) deliberately playing the game in a way not intended by developers by adapting the rules. In the former, participants cited using the in-game difficulty scaling to create additional challenges for games they were already familiar with (i.e. had already played through at least once), such as in the case of one participant who, referencing *Wolfenstein: The New Order* (MachineGames, 2014) said he "decided to [play] it on the hardest difficulty just because I enjoy it so much" (male, 26, interview). Many games allow players the option to either lower or higher the difficulty either at the start of the game, or else at any point during it.

Where participants had mentioned playing games in ways not intended by developers by adapting the rules, the most common example cited was speedrunning. This involved intentionally altering the overall goal of the game to finish it as fast as possible and created additional challenges in the way the game needed to be played. As one participant referenced in relation to *Skyrim* (Bethesda Game Studios, 2011):

> *"I did a speedrun where instead of trying to beat the game, it's got a weird name; it's called Chef%. Basically, it's a speedrun in which you try to collect a chef's hat and a chef's top and then try to make like some meatloaf thing and make like five meals as quickly as possible and then, even though you don't beat the game, you just stop the time when you've completed what is considered the Chef% run."* – Male, 36 (Interview)

In terms the use of glitches participants often held mixed views with some feeling that the use of glitches detracted from the way a game was meant to be played. As one participant noted, glitches could disrupt the experience in games which were based on real-life historical events:

> "I feel often with strategy games because ones I play are historical I'll tend not to use the glitches because it doesn't feel like it's the proper history but, you know, that's a personal preference thing." – Female, 33 (Interview)

Others used glitches as a form of exploration and fun with the most common cited being the "MissingNo" glitch in *Pokemon Red and Blue* (Game Freak, 1996). Many participants cited they wanted to "try out" glitches which they had heard about, suggesting that curiosity was the main motivational factor and that they were exploring what was possible within the game.

Glitches were also used for more serious activities such as speedrunning. Whereas participants who had cited using glitches as a form of exploratory usually referenced more openly structured games (e.g. open-world games), those who used glitches in a more serious manner often referenced more linearly structured games where the route of play was dictated (e.g. the player had to clear one area before moving to the next). As one participant referenced when he discovered a climbing glitch which aided him in his speedrun of the game *Strider* (Capcom & Double Helix Games, 2014):

> "We found that if at any point for a single frame one of those hooks goes between two parts of the ceiling that are at a 45-degree angle to each other, he has like a vaulting animation to get on top of ledges and the game freaks out, thinks you're on the other side and vaults you outside of the room. And so that is basically used to bypass two thirds of the game essentially and skip to the latter half." – Male, 27 (Interview)

In examples of speedrunning, glitches were commonly used to bypass sections of the game. In this way glitches were used strategically in order to overcome new challenges players had created.

3.3. Creativity as Affective Change

Creativity as affective change was an inductive theme which developed during the analysis, to capture the ways in which participants views of themselves and the world had changed as a result of playing games.

The most frequently cited instances of affective change involved a game narrative invoking personal reflection and changes in perception regarding moral and cultural issues. Often this was in relation to games which allowed the play to choose dialogue options such as *The Elder Scrolls V: Skyrim* (Bethesda Game Studios, 2011) or *Mass Effect* (Bioware, 2007). As one participant illustrated in reference to *Fallout 4* (Bethesda Game Studios, 2015):

> "[It] really called into question the concept of humanity. The whole game theorises the idea of whether synthetics and 'zombies' can be seen as human and this really questioned my ideologies on what makes someone human." – Female, 30 (Narrative Survey)

Through providing strong narratives, often involving dialogue choices, players can explore aspects of their personality they may not have been given cause to analyse otherwise. While many participants cited these instances of affective change in a positive light, it is worth noting, that some participants also recounted negative feelings associated with such experiences, such as the depiction of the game *This War of Mine* (11 Bit Studios, 2014):

> "It's fantastic but it's awful because it makes you feel things, like consider things that you didn't really have to think about previously. And it helps you think about how people can - the things that you have to do to survive and then obviously, it makes you feel bad. It's like, dude, this is actually a really bad decision and this is actually a really hard time. And you understand what many people had to go through." – Male, 30 (Interview)

In the example above, parallels were drawn between the game's narrative and similar situations in real life leading to changes in perceptions and deeper understandings. Similarly, participants mentioned games in which they could connect with the characters or situations on a personal level to be especially good at allowing them to view a situation or individual from a different light. As one participant illustrated:

> "There have been some really good games in the past, and it's all about good story telling and good character development. And when you start to relate to characters, you sort of start to, it can actually raise your awareness of different types of people, different conditions and things like that." – Female, 31 (Interview)

Often participants had experienced similar situations in their real-life and through playing a game portraying a similar situation were able to derive new insight and understanding of the issues at hand. Reflection and personal change were not solely instigated by the game's narrative, but also within the mechanics of gameplay itself. Many participants mentioned how games taught them that failure was acceptable. As one participant put it when referencing the game *StarCraft II* (Blizzard Entertainment, 2010):

> "If you lost a game, it's not that you played very bad, maybe you played very well, so it's better to lose a game versus a world class table tennis or football player: that's an achievement I think. So, it depends on the situation. And you will always make mistakes, but I think it's how you use that experience."– Male, 34 (Interview)

Similar to this, a few participants also mentioned viewing competition in a new light with one participant stating that he was only able to fully understand how people managed to become masters at games after he had "thrown himself at it about several million times" (Male, 23, interview).

In essence, while games that utilize strong moral and emotionally challenging themes may provide limited possibilities for different types of play such as alternate routes through the game or different strategies to use in combat, they can provide complex and extensive dialogue options. Such options allow the exploration of not only the moral or emotional issues at hand but also the personality of the player. This exploration invokes personal reflection, changes in identity and

worldviews and the creation of personally meaningful insights. In addition, games which may not be as strong on narrative can still offer players opportunities for meaningful growth. Games provide players with a safe space to fail, allowing them to come to terms with what it means "to be bad at something" and instead view failure as a development opportunity and learning experience.

3.4. Design Considerations

Three main categories of creative expression were defined from this study. In terms of how these types of expression related to different types of games, an additional category was developed during analysis, focusing on the specific possibilities for creative expression in games. The different types of design considerations contributing to creative expression were as follows: *freedom of play, tools, environment, replayability, avatar* and *creation*.

Freedom of play related to games which allowed the player to experiment with different ways of doing things and accommodated different player motivations. The majority of games referenced by participants in this category were newer, open-world or MMO games such as *Monster Hunter: World* (Capcom, 2018) and *Legend of Zelda: Breath of the Wild* (Nintendo, 2017). These games were non-linear, allowing the player to choose what route to take, in addition to providing opportunities for diverging from the main game narrative in the form of side activities. The inclusion of side quests and activities such as crafting, cooking and mini-games added variety to the play experience and allowed exploration and discovery of game elements. As one participant put it:

> "When you realize you're playing a game where you're not asked to just go from A to Z, and where problems and puzzles can be solved in thousands of ways, sometimes in the most apparently uncanny way you could imagine, using every item or enemy or character in your surroundings... it makes the game feel like a true challenge, and the victories feel much more real." – Male, 36 (Narrative Survey)

Additionally, the majority of participants cited games which afforded *freedom of play* as being the most engaging and granting the greatest sense of achievement. Games which offer players multiple possibilities enable different types of player motivations to be catered for, and as a result provide a meaningful play experience where players are able to express their creativity through such things as experimenting with different strategies, creating social conventions, and tailoring their route through the game.

The inclusion of different *tools* such as weapons, abilities and actions also added to customisation of the experience and was synonymous with the expression of creativity as problem-solving and appropriation. More tools at a player's disposal allows for a greater number of combinations and ways to solve ill-structured problems. While the majority of these combinations

are accounted for by the developers, there is still opportunity for emergent play and the discovery of exploits and glitches.

> "You can do lots of different combinations of different weapons and things like that. And you have to think on your feet about different strategies to use and stuff like that to defeat the enemy." – Female, 31 (Interview)

Opportunities to explore the *environment* and interact with it were also cited as important considerations for creativity. Participants talked about how the environment played a significant role in the expression of creativity in terms of problem-solving and appropriation. In the former, the environment was utilised in strategy creation, often involving interactive objects and terrain. As one participant illustrated in reference to *Monster Hunter: World* (Capcom, 2018):

> "So you can get like little balls of water mossy stuff and there are monsters that cover themselves in mud to protect themselves, but if you get this little ball of moss and you shoot it with your crossbow, it actually cleans the mud off the monster and it's like the game doesn't tell you this is a thing that you can do, but you can just go around and pick up little clumps of moss and pew-pew them." – Male, 23 (Interview)

Allowing players to not just passively experience the game world but play an active role in interacting with environmental elements enables the discovery of different game aspects. This discovery is not solely confined to the use of interactive environmental objects, but also what effects such objects may have on the wider game world.

In addition to freedom of play and environmental interactivity, participants also cited *replayability* as being a major feature in allowing them to be creative. Most often involving single-player games, *replayability* involved the different ways that the game could unfold, often resulting in different endings based on player choices and routes taken through the game. Games which afforded these options encouraged players to replay them to discover the outcome of different actions, making each playthrough a unique experience. In reference to the single-player game *The Witcher 2: Assassin of Kings* (CD Projekt Red, 2011) one participant detailed how the game could unfold in numerous ways based on the player's actions:

> "[There is] like two completely different areas depending on your choice at that stage in the game…even with small sub-quests there's consequences depending on what you choose. It can be anything as little as what item you get as a reward, right up to effecting quests staged through the game later on." – Male, 31 (Interview)

Replayability was related to the game structure, with linearly structured games providing less opportunities for renewal of the gaming experience. As one participant noted: "why am I going to

beat What Remains of Edith Flinch again if it's pretty much a linear story?" (male, 30, interview). In this way, *replayability* was tied to both the gameplay itself (e.g. in terms of different areas to explore, different consequences) and the narrative (e.g. the story can unfold differently each playthrough). The possibilities for divergent narratives was most synonymous with the expression of creativity as affective change where participants often played through the game multiple times choosing different options or taking different actions each time. Each new experience highlighted important decisions within the game's narrative and allowed players to explore the consequences of their actions.

The category of *avatar* related to possibilities for customisation in terms of both look and personality of the playable character. For instance, it was noted that in some games dressing the player's avatar became an additional goal in itself, with one participant even noting that he disregarded item stats in favour of looks (male, 26, interview). In addition, games which allowed participants to define the personality of their character gave opportunity for the expression of creativity as affective change. Different dialogue options relating to character personality traits allowed the exploration of alternate identities – for example one player attempted to play through *Mass Effect* (Bioware, 2007) as a renegade character (characterised by aggressive, ruthless dialogue options) and found it too difficult to continue playing due to the clash with her own personality.

> "I tried to play a renegade character in Mass Effect. It didn't work, I can't bring myself to be that type of person even though it's not real." – Female, 21 (Narrative Survey)

Finally, in terms of *creation,* participants noted games which allowed freedom to tailor the gaming environment through creation of structures, a feature most commonly cited in relation to sandbox style and simulation games. The freedom of creation that such games allowed provided opportunities for players to tailor the game to their own goals and create, in some cases, almost anything they wished. As one participants noted in relation to *The Sims* (Maxis, 2000):

> "I have created material within the Sims where you can build/decorate houses. This allowed me to create a universe and made it an enjoyable way to play the game." – Female, 30 (Narrative Survey)

When it came to map and level editors, several players "tried out" designing their own levels and maps. However, this was usually referenced in more explorative terms and "mainly just for fun" (male, 34, interview), rather than a serious activity. For example, as one participant described:

> "I've done a couple of little bits and pieces physically to a game. So a couple of maps and levels and things. But it tends to be if the game comes with its own map-maker or editor or something. I haven't gone into and modified the code and made a full standalone mod." – Male, 26 (Interview)

Finally, participants cited games which were freely open to player modifications such as *Skyrim* (Bethesda Game Studios, 2011) and *Minecraft* (Mojang, 2011) and usually included game mod editors. As one participant explained:

> "I enjoy modding it [Minecraft], so adding things that weren't in there originally. And I am fascinated by automation systems, so I'll have mods that allow me to instead of building my own stuff, I'll start a factory that will build the stuff for me." – Male, 26 (Interview)

By allowing the implementation of player mods, additional functionality can be added to the game which allows players to customise their gaming experience further.

4. Discussion

4.1 Expressivity of Creativity

In *creativity as problem-solving,* participants referenced *creating strategies* and *approaching problems* in novel ways. Problem-solving has been argued to be a core component of creativity, where the problem represents a gap in knowledge and creativity represents the strategies or actions required to overcome it (Treffinger, Selby, & Isaksen, 2007). This view of creativity requires two conditions in that the solution needs to successfully solve the problem and the solution needs to be novel in relation to the individual. The same response may be creative for one individual whilst routine for another who is merely recycling a previously created solution (Mayer, 1983; Weisberg, 1986). In line with other literature which mentions creative problem-solving in games (e.g. Gee, 2005; Jackson, 2012; Kiili, 2005), participants in this study frequently mentioned creating strategies or tactics to overcome gaming challenges. While these strategies may not have been universally novel, they were unique for the players who created them, something which echoes back to the notion of Little C creativity (Maslow, 1968; Richards et al., 1988) which refers to the personally unique ways in which individuals solve everyday problems.

Participants spoke about refining their strategies through "a process of elimination" and "picking apart" the outcome to determine what they did correctly and what went wrong. This process of constant reflection and refinement involved in the creative problem-solving process can be illuminated by Kiili's (2005) Experiential Gaming Model (EGM) which describes how games may act as means of for players to develop their creative problem-solving skills. The EGM, created for the purposes of designing and studying games, suggests challenges are constantly provided to players at their optimal skill level; facilitating a flow state (Csikszentmihalyi, 2014) which in turn acts as a

motivator for creative behavior. The creation of solutions to these challenges takes place twofold: firstly, within an unstructured and chaotic phase where the player does not take notice of the wider restraints of the game world, and secondly, within a refinement phase, where ideas are contextualised in relation to the constraints, resources and limitations of the game world. Through such reflective observations, motivated by a flow state, players are able to hone their creativity by overcoming ill-structured challenges (Kiili, 2005). Furthermore, the sense of achievement which comes from "working it out" may act as a motivator for creativity, something which is in line with Gee's (2003) Discovery Principle which states that games are especially good at providing players with the opportunities to experiment and make their own discoveries.

While references relating to *creating strategies* often took place in single player offline games, it was also cited in relation to MMORPGs. It has been argued that creativity is grounded in both individual and social experiences (Vygotsky, 2004) and can be seen not only in solo contexts but also in the collaborative processes involving team-based problem-solving, communicating and blending and reconfiguring ideas (Ferguson, 2011; Hobbs et al., 2006). As one participant illustrated in his example of a raid in *World of Warcraft* (Blizzard Entertainment, 2004), when a group shares a challenge and engages in collaborative brain storming, each member is able to expand and build on one another's ideas, promoting creativity and "out-of-the-box thinking" (Bell, 2010).

In terms of *approaching problems*, participants noted a variety of ways in which they prepared for difficult challenges and mitigated frustrating gaming experiences. Instead of giving up in such situations, participant's referenced ways in which they managed these instances such as "taking is slowly" and "taking a break" – something which is echoed by previous work on gameplay breakdowns. Breakdowns include instances where existing strategies no longer work (Ryan, Street, & Siegel, 2009) and where the flow of gameplay is interrupted (P. Barr, Noble, & Biddle, 2007). Previous work on gameplay breakdowns by Iacovides et al. (2014) found participants invoked strategies such as taking a break when things became too frustrating, or consulting external resources such as guides, videos and friends. Strategies such as taking a break allowed for reflection on the particular challenge, as well as being able to provide the space for the creative incubation period and subsequent insight moments. In the incubation period time is taken away from the issue at hand, allowing both the conscious and unconscious mind to "incubate" on the problem. Especially with ill-structured problems such as those in games, the solution is suddenly discovered in a moment of creative insight (Pols, 2002; Sawyer, 2013). Furthermore, it has been suggested that frustrating experiences in games may contribute

to an increase in emotional intelligence by allowing players to "learn new coping strategies when in a negative emotional state" (Velikovsky, 2014, p. 7).

Creativity as appropriation included the different ways in which gameplay could be appropriated and included finding *new uses for existing game mechanics*, *creating new challenges* and using *glitches*. It has been argued that appropriation and creativity go hand in hand, where appropriation is a creative process in which users are able to go beyond the affordances of a particular technology, defining and reinventing the user experience (Degele, 1997). Finding *new uses for existing game mechanics* was one example of how gameplay was appropriated by players. Such combinations of game variables are not strictly cheats but can be classified as "emergent exploits" which are "actions that are 'found' by players within the existing code of a game and appropriated towards succeeding at the game in new and often contentious ways" (Jarrett, 2014, p. 4).

The structure of a game appeared to influence how players appropriated their gameplay, with references to finding *new uses for existing game mechanics* occurring mainly in openly structured games, and the *creating new challenges* in more linearly structured games. According to Caillois (1958) the move from *ludus* (highly structured play) to *paidia* (loosely structured play) affords improvisation and creativity to players. This "openness" allows for greater player interactivity and personalisation in terms of gameplay (Herodotou, 2009). Openly structured games provide players with a variety of different ways to play, tools to utilise and environments to explore. While participants cited discovering new game mechanics and combinations, many suggested newer games were far more "polished" and presented little opportunities for playing in ways unintended by developers.

Using Aarseth's (2007) notion of the implied player, newer games are structured towards a set of expectations on how the player will behave. In order to progress in the game, the player has to complete these expectations, thus imposing a "limitation to the playing person's freedom of movement and choice" (Aarseth, 2007, p. 132). Actual player behaviour on the other hand, often goes beyond how the game is supposed to be played, leading to transgression of the implied player model. These instances of transgressive play involve gameplay which is not within the games intended repertoire and can involve emergent elements such as exploits. Modern games subscribe to an underlying ideology of "meritocracy" between players and developers, with developers constantly striving for a perfect balance of gaming variables (Paul, 2012). However, this imposed balance often limits such opportunities for transgressive and creative forms of play.

More linearly structured games were most often referenced in terms of *creating new challenges*, with the most common examples involving speedrunning. As with Schäfer's (2011)

distinction between implicit and explicit participation, it seems that implicit participantion may be more likely in openly structured games. This type of creative expression is already within the constraints of the game, such as object creation in *Minecraft* or creating different outfits using armor in *Monster Hunter: World*. The opportunities for these actions are already available to players, although the combination of such actions can be unintended. More restricted and structured games involve explicit participation, such as speedrunning whereby an entirely new goal is created through adaptation of the game's rules, involving the use of glitches which were never intended by developers.

Glitches were cited in both openly and linearly structured games, however, several participants referenced using glitches mostly in older games such as *Pokemon Red and Blue* (Game Freak, 1996). Participants views on using glitches suggested a dichotomy between using glitches in a non-serious way and using them as an exploit (Consalvo, 2009). This illustrates the shifting meaning of what is defined as acceptable forms of creativity within the game. For example, in the speedrunning community the use of glitches to bypass areas of the game is textbook behavior in certain types of "runs", however, in others such as "glitchless runs" their use is prohibited.

Creativity as affective change was an inductive theme developed during the analysis and included the ways in which games impacted upon or altered players perceptions, beliefs and viewpoints. While not immediately an obvious expression of creativity, the concept of Kaufman (2009) and Beghetto's Mini C serves as illumination of how creativity not only involves creating something (whether that be an object or a set of abstract solutions), but can also involve personally meaningful change and insights. Based on the Vygotskian notion of cognitive and creative development, this view argues that all individuals have creative potential through the "internalization or appropriation of cultural tools and social interaction" (Moran & John-Steiner, 2003, p.63) where they can reorganize and transform information and mental structures based on their own characteristics and pre-existing knowledge. Thus, Mini C creativity occurs through the fluid and interpretive process of creating personal knowledge within a particular milieu. In this way, one expression of creativity in games can involve a player's reflection on the game's narrative and as a result, the alteration of thought patterns, beliefs and perspectives.

These shifts in perception could be seen as a response to the emotional challenges which some games provide (Bartsch & Hartmann, 2017). Emotional challenges can "confront the player with emotionally salient material or the use of strong characters, and a captivating story" (Denisova et al., 2017, p. 2513). Unlike functional challenges in games which require feats of problem-solving, dexterity or physical skills (Cole et al., 2015), emotional challenges cannot be overcome by

conventional means. Instead such challenges are tied closely to the game narrative and involve resolving tensions built up by characters, story and exploration of emotional states (Bopp et al., 2018). In the current study, participants who cited games with emotional challenges often recounted the experiences as being highly valued and enjoyable due to the range of emotions they elicited and how such challenges made them "question" things; a finding similar to a recent study by Mekler et al. (2018) which found that players considered reflection on and around games to be a worthwhile activity in itself.

Where affective change occurred from drawing parallels between the game narrative and real-life suggested transformative reflection whereby behaviors or assumptions are altered and new insights are gained (Mekler et al., 2018). The negative feelings of sadness, shock and betrayal elicited by games with strong emotionally challenging narratives was a finding similar to Bopp et al.'s (2018) study which found that games which presented players with difficult decisions often elicited feeling of negative valence. However, through confronting such challenges players are able to analyze and reflect on why they experience such emotions and derive personally meaningful insights as a result.

Instances of affective change also occurred in relation to gameplay itself, most notably in terms of dying or failing. Several participants spoke of challenging games in which they had come to view failure as an opportunity to refine and improve their strategies. The ability to view failure as an opportunity has been described as an important aspect of creativity (Binkley et al., 2014). In this way failure can promote self-inquiry, personal growth and allows such instances to be converted into learning experiences (Saavedra & Opfer, 2012).

4.2 Design Considerations for Creativity

Design considerations was an inductive theme which centered on the specific design elements which facilitated the different forms of creativity. The most common sub-theme was *freedom of play* which related to a game's propensity to accommodate different player motivations and playstyles. Allowing the player freedom in terms of how to play, what routes to take and what other activities to include in the gaming experience ties in with Craft et al.'s (1997) argument that a core element of creativity is "possibility thinking", involving experimentation through play and asking "what if" questions (Craft et al., 1997). In this way, there is no convergent "A-Z" solution; instead there are numerous game variables which can be combined in multiple different ways, promoting creative cognition skills such as divergent thinking (Finke et al., 1999). In terms of the current study, the majority of participants cited enjoying games where they could experiment and try different things to see what the outcomes would be.

While linearly structured games offer *freedom of play* to a certain extent, the predominant type of game referenced was games designed with an open-world structure. For these types of games, players are allowed almost complete freedom on a variety of levels, with choices for play constantly evolving. Participants cited games which afforded the most possibilities to be the most engaging, something which could be illustrated by Salisbury and Tomlinson's (2016) tenth condition for Flow which states that "an activity must present an opportunity for meaningful growth of the self which is valued by the individual" (Salisbury & Tomlinson, 2016, p.72). Referencing Alan Cooper's (1999) concept of the idealised persona, they argue that games which are designed to cater for different personas (e.g. playstyles) such as open-world games are able to meet this requirement most easily.

While game structure impacted upon player creativity, the game *narrative* also proved to be an area which contributed to creativity; most notably in the form of affective change. Games where players are provided with a malleable game narrative such as *The Witcher 2: Assassin of Kings* (CD Projekt Red, 2011), highlights the distinction between games and other more closed and complete creative mediums such as film and literature. As Collins (2013) points out, games require an active role from the player in order to be fully experienced. Both the ability and creativity of the player is what enables each gameplay experience to be so diverse (Bowman et al., 2015). Just as some have argued that theatre requires an active audience to be fully realised (e.g. Balcerzan & Osinkski, 1966), digital games can also be seen as a form of co-authorship between players and game designers as creative input from both parties is required in order for games to be fully finished products (Bowman & Banks, 2016).

Furthermore, the structure of the game (e.g. open versus linear) and the structure of the narrative (e.g. divergent versus linear) determined opportunities for *replayability*. In the case of this study, the majority of references relating to multiple playthroughs related to games which encompasses different endings and divergent narratives. Such opportunities allowed players to not only explore the game differently each time in terms of new environmental areas, but also, in terms of the multiple ways the narrative could unfold. Such narrative exploration can be realised through branching storylines allowing for different possible outcomes in the game. Young and Cardona-Rivera (2011) argue that narrative affordances comprise of narrative events which encourage players to envisage possible outcomes to the story. In relation to such divergent narratives, player creativity is encouraged by providing a selection of possible outcomes- each of which may correspond differently to the players' current cognitive state.

The game *environment* was also cited to be an important design consideration, with opportunities to both explore and interact with the environment being conductive to player creativity. The propensity of games to offer opportunities for environmental exploration could be illustrated through the concept of ludic space. According to Aarseth (2012), games contain two types of space – the ludic space and the extra-ludic space. The ludic space relates to the area which is playable, while he latter refers to the surrounding space where the player cannot explore. Depending on the type of game, the two types of space vary e.g. in a linearly structured game the majority of space is extra-ludic, whereas in an openly structured game the opposite would be true. The majority of references relating to exploration of the environment concerned open-world games, suggesting that extending the ludic space available to players provides greater opportunities for creative action.

Opportunities to interact with the environment, as well as a variety of *tools* such as items, weapons and abilities provided greater scope for creativity as problem-solving and appropriation; something which may be illuminated by Linderoth's (2013) ecological approach to digital games whereby players are able to perceive affordances for interaction within their perceptual field. The perception of such affordances undergoes further refinement with the player making "more and more complex distinctions in her/his perceptual field" (Linderoth & Bennerstedt, 2007, p. 608). However, while such refinement of the perceptual field may result in creative actions (e.g. such as in the combination of environmental variables), as Linderoth (2013) points out by simply perceiving the interactable value of the environment, the "real" objects which the game is meant to depict may become peripheral. However, as was the case in the example provided in section 3.4 relating to the participant who used balls of moss to defeat a foe in *Monster Hunter: World* (Capcom, 2018), the role of cognition was crucial in establishing why throwing balls of moss allowed the monster to be defeated (e.g. the moss washed away the heavy mud protecting the monster). In this way, some recognition of the "real" objects may occur which links the cognitive processes associated with understanding (e.g. the mechanics of the game), comprehension (e.g. engaging and following the game narrative) and retrieval of prior knowledge (e.g. using strategies from similar games) (Cardona-Rivera & Young, 2013; Shuell, 1986).

Finally, in terms of opportunities for the *creation* of game content, participants cited instances in which they had created objects or implemented modifications. The most common type of *creation* involved building in-game structures such as in sandbox style games like *Minecraft* (Mojang, 2011). Games which allowed players freedom to create often involved appropriation, where players experiment with and personalize their gaming experience. Linking back to Little C approaches which refer to everyday creative activities which the average person is able to

participate in (Richards, 1990), participants who referenced using map and level editors predominantly spoke of using them in a explorative manner. It could be that games that include packaged map/level editors support this this type of creativity by providing players with the opportunity to pursue their curiosity and dabble in elements of game design. Furthermore, by permitting the implementing modifications the possibilities of play are extended, providing players who were often already familiar with the original game, with a new gaming experience. Such examples often fell under Burri's (2011) third category for user created content, whereby player creations and modifications are freely allowed and, in some cases, form the core of the game.

5. Implications and Future Research

5.1. Implications

The implications of this study are fourfold. Firstly, the findings add to the currently under-researched area of creativity in digital games. Previous studies have focused on the problem-solving (e.g. Kiili, 2005) and appropriation (e.g. Jarrett, 2014, 2015; Wright et al., 2002) aspects of creativity in digital games. The findings from our study confirm previous research in these areas, but also categorise these forms of creativity into main and sub-categories. Several additional elements of both problem-solving and appropriation were discovered. In terms of problem-solving, the unique ways players approach and plan for difficult challenges (*Approaching Problems*) were illuminated, adding to the existing body of literature on how games facilitate creative problem-solving. In terms of appropriation, it was found that players could create additional challenges (*Creating New Challenges*) not intended by developers such as speedrunning; something which has not, as far as the authors' knowledge, been addressed in previous research.

Secondly, we used a definition of creativity which is extensive and includes not only creativity in terms of novel solutions and ideas, but also personally meaningful interpretations and viewpoints (Kaufman & Beghetto, 2009; J. G. Young, 1985). Few studies have examined creativity from an affective change perspective and little is known about how particular design considerations such as being able to choose the playable character's personality may contribute to affective change in players. Previous studies which examined aspects of affective change such as reflection found both the narrative and mechanics of the game could facilitate both self-reflection and reflection of past experiences (Mekler et al., 2018), something which this study is able to confirm. Additionally, similar to both Mekler et al. (2018) and Bopp et al. (2018), it was found that despite presenting players with emotionally challenging narratives which involved instances of reflection and/or

emotional discomfort, many participants cited these experiences as enjoyable. This highlights the importance of design considerations such as *avatar, narrative* and *replayability* which support creativity as affective change.

Thirdly, although not the main focus of this study, the ability of games to inspire experiential learning and aid skill development has been well documented (e.g. Barr, 2018; Qian & Clark, 2016; Sourmelis et al., 2017). While the findings outline the different forms of creative expression in digital games, little is known, still, about what specific creative skills players may develop from engaging in these different forms of creativity. As such, one implication of this study is to provide the groundwork for future investigations into exploring this area and establishing what links there may be with different creative expressions and learning outcomes.

Finally, the findings of this study aim to inform game design both within entertainment and educational contexts. This would benefit game developers and educators in providing a framework of the particular design considerations which support creativity. Mapping design considerations specific to creativity can inform the design of future games that explicitly support creative play. It can also inform the design of formal learning experiences such as online learning courses that are structured around problem-solving, appropriation and affective change. As shown in this study, these elements can foster creative expression, which is one of the so-called 21st century skills (e.g. Binkley et al., 2012; Pellegrino & Hilton, 2012) that educational systems should seek to nurture.

5.2. Limitations and Future Recommendations

Firstly, it has been argued that qualitative studies should gather data from 30 or more participants due to the "central limit theorem" where the more cases acquired correlate to how generalisable the conclusion can be (Mayring, 2007). The data from a total of 38 participants was collected for this study using two different collection methods to allow for data triangulation. Triangulation of data sources facilitates greater reflexivity during analysis (Mays & Pope, 2000) and by utilizing semi-structured interviews and a narrative survey, data could be compared and contrasted. Both methods were qualitative and further studies could benefit from adding quantitative methodologies to enable further validation. Additionally, while investigator triangulation was achieved through cross-checking of thematic codes by three colleagues (involving going through the initial codes developed by the principal researcher for consistency and accurate portrayal of concepts), the use of multiple independent coders to achieve "intersubjective consensus" (Miles & Huberman, 1994, p.11) would further aid external validation in subsequent qualitative studies.

Secondly, it may be that creative individuals are more drawn to games in general and that as a result they may become more creative (Jackson, 2012; Jackson et al., 2012; Ott & Pozzi, 2012). The majority of participants in this study were already engaged in other creative pursuits such as writing fiction, playing and composing music and creating arts and crafts which may have made them pre-disposed to being creative in digital games to a higher degree, or at least more aware of their own creativity when playing. As such, a comparative study of gamers and non-gamers could help to determine whether their perceptions of creativity differ, as well as aspects of creativity that may transfer between domains. Furthermore, it would be beneficial to compare between those who currently engage in other creative pursuits and those who do not.

Finally, according to the Entertainment Software Association (ESA) in the US 46% of gamers are female and 54% male (ESA, 2019). In Europe the numbers are the same (ISFE, 2019) and in the UK the numbers are similar with 42% of gamers being female and 58% being male (Ukie, 2018). While the narrative survey contained an equal number of both genders, the interview participants (including pilot) consisted of 16 males to 8 females. As such the views presented in this paper may be somewhat biased in favour of male opinions. While measures were taken to try and equalise the numbers of male and female participants, predominantly male volunteers responded to the recruitment emails and went on to schedule interviews. Due to time restrictions on this study it was not possible to recruit additional female participants for interviews. For future studies it would be worth attempting to gain an equal number of both genders.

6. Conclusions

A qualitative methodology was adopted consisting of explorative semi-structured interviews and a narrative survey to explore what expressions of creativity occur across different types of digital games, and, what game design considerations facilitate player creativity. Participants who took part were regular gamers and played a variety of different games on various gaming mediums. In total the data from 24 interviews and 14 narrative surveys was analyzed using a hybrid thematic approach consisting of both deductive and inductive phases.

Three main forms of creative expression were identified, along with seven design considerations which supported them. Please see Figure 1 for an illustration.

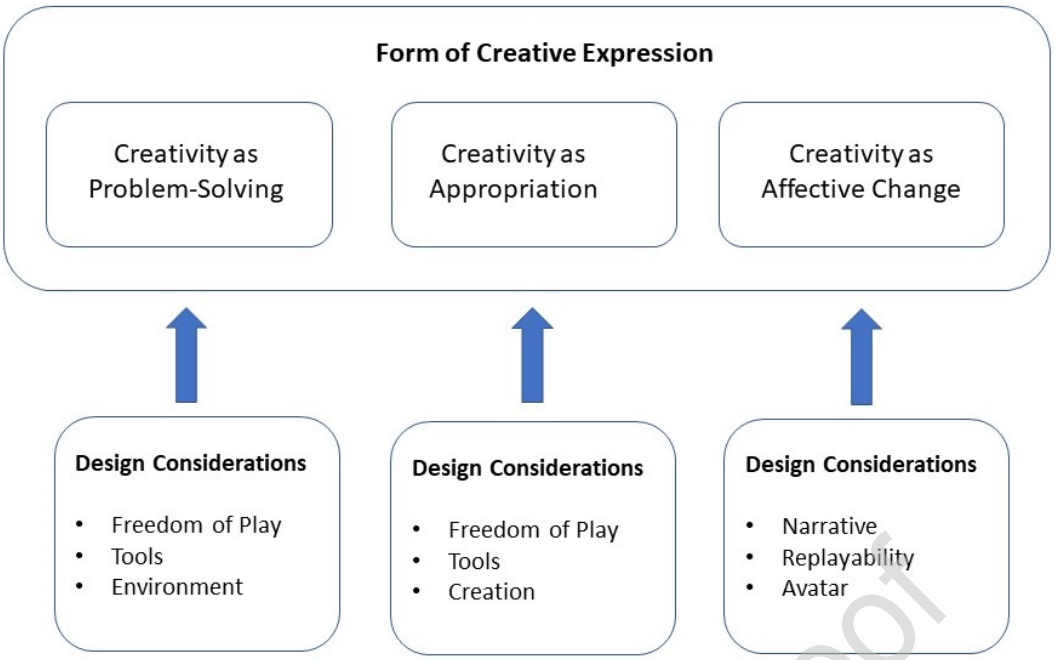

Figure 1: Forms of Creative Expression and Supporting Design Considerations

Creativity as problem-solving involved the creation of novel strategies, usually via an experiential approach involving reflection and further refinement. When strategies were not successful or led to a gameplay breakdown, participants mentioned various ways in which they managed such instances. Creativity as problem-solving was promoted by design considerations for *freedom of play, tools* and *environment* which allowed players the opportunity to try out different ways of doing things, combine different game variables to form novel strategies and use the game terrain to their advantage.

Creativity as appropriation included the ways in which players engaged in emergent and transgressive forms of play, often deviating from the way the game was "meant" to be played. Examples of this included finding alternate uses for existing game mechanics, using glitches both as a form of exploration and progression, and creating additional challenges such as altering the overall goal of the game in the case of speedrunning. Design considerations for creativity as appropriation included testing the boundaries of permitted gameplay through *freedom of play*, fostering emergent forms of play by providing a variety of *tools* and allowing games to be open to player *creation* by encouraging and permitting player modifications.

Finally, creativity as affective change involved interpretations of the game that became personally meaningful, evoking reflection and personal change and was often fostered by emotional challenges presented by the game *narrative*, through *replayability* involving exploration of different game endings and, finally, personality exploration through *avatar* customization. Furthermore, the

mechanics of gameplay allowed participants to reflect on and come to terms with failure, instead seeing it as an opportunity for improvement and learning.

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Highlights: Expressivity of Creativity and Creative Design Considerations in Digital Games

- Player creativity in digital games can be categorised into three main themes.
- Creativity as problem-solving involves novel solutions/approaches to challenges.
- Creativity as appropriation involves customisation/adaption of gaming experience.
- Creativity as affective change involves personally meaningful interpretations.
- Expression of different forms of creativity depends on the type of game.